



DIY

Worthwhile projects you can build on your own



2-meter tape measure Yagi antenna

In the [June 2017 issue](#) of the *UVARC Shack*, we featured the 2-meter tape measure Yagi antenna, but that article was merely a reprint of an online PDF that unfortunately was a little difficult to read and omitted a lot of instruction detail. I hope to get it right this time, by including good descriptions and a more comprehensive tools list.

This handheld Yagi antenna is designed for *radio direction-finding*, to help you locate the source of a signal, such as a hidden transmitter (*fox*), or to focus your signal better into a distant repeater or other station. People have built these at two hamfest tables that we've set up, plus at a build-it club night, and have reported good results with them.



Parts list

- 12 feet of 1" wide tape measure
- 5 feet of [RG-8X coaxial cable](#)
- 23-½" of ½" PVC tubing
- Two ½" PVC slip crosses
- Ten 8" zip ties
- One RG-8X crimp connector of your choice, such as [SMA-female](#) (Baofeng), [SMA-male](#) (Yaesu), or [BNC-male](#) (Icom or older)
- 5" of 12 AWG solid copper wire
- One ½" PVC slip T
- One ½" PVC slip cap
- One ½" heat shrink tubing, 2" long

Tools list

- [RG-8X crimpers](#)
- [100-watt soldering iron](#)
- wire strippers
- [heat shrink gun](#)
- tin snips
- utility knife
- [solder](#)
- wire cutters
- [zip tie gun](#)
- [sanding block](#)
- Sharpie
- [PVC cutter](#)
- scissors
- small Phillips screwdriver
- [ohmmeter / DMM](#)
- paper towels

Might also help to have a power strip, short 2x4 stud (to solder and sand on), an ice pick or paper clip (for separating the coax braid), packing tape (to collect the cut braid wires), and wet wipes.

DIY, continued

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Assembly instructions

Install the selected crimp connector to one end of the coax (if not already done):

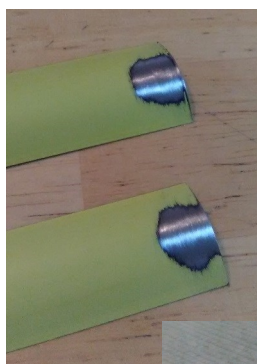
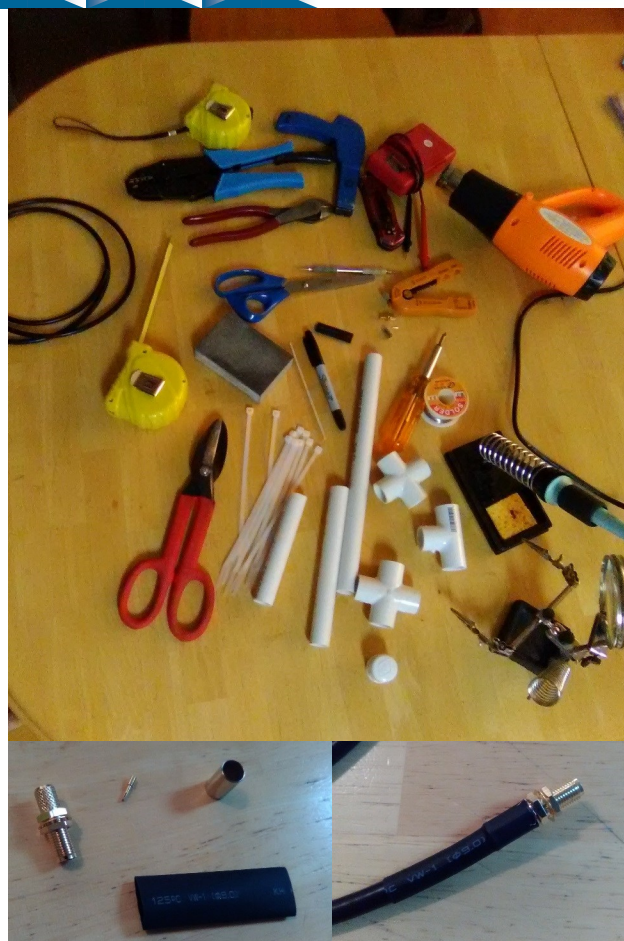
1. Slide the crimp sleeve and a piece of heat shrink tubing onto the coax
2. Carefully remove $\frac{3}{4}$ " of the outer coax jacket with a knife, remembering not to slice the shield
3. Unbraid the shield with a pick or paper clip, and cut off all but $\frac{1}{4}$ " of the shield
4. Strip off half of the center conductor and cut off all but $\frac{1}{4}$ " of the foil
5. Solder the connector center pin to the coax center conductor
6. Slide the connector body onto the center conductor insulation, pushing the center pin to enter the center of the body
7. Slide the crimp sleeve over the remaining shield, pushing the shield wires over the crimp portion of the connector body, then crimp the crimp sleeve
8. Slide the heat shrink tubing completely over the crimped sleeve and heat-shrink it

Cut the following four pieces of the tape measure, making the antenna *elements*:

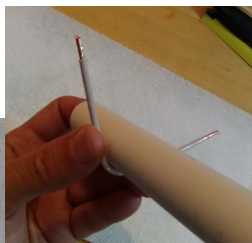
One 41-3/8"

One 35-1/8"

Two 17-5/8"

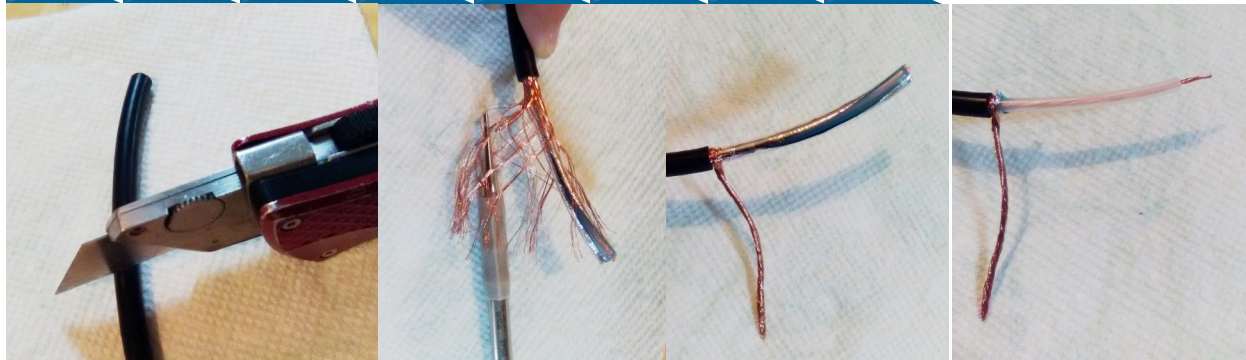


On one end of each of the 17-5/8" elements, completely sand off the paint about $\frac{1}{4}$ " wide and $\frac{1}{2}$ " long, then clean off any dust. Heavily tin (coat with solder) the exposed metal on both pieces. Strip about $\frac{1}{4}$ " off each end of the 5" solid 12 AWG wire and tin both ends with a little solder. Bend the middle of the 5" solid wire halfway around one of the PVC tubes (as a form) until the ends are parallel and even with each other. This is the *hair-pin match*.



DIY, continued

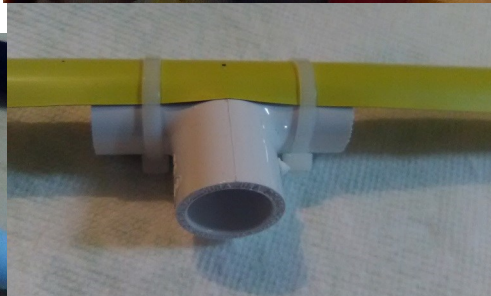
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Carefully remove 1-½" of the outer coax jacket of the unfinished end of the cable with a knife. Unbraid the shield, twist the shield wires into a single stranded wire, and cut off all of the foil. Strip ¼" off the center conductor wire, then separately tin both the exposed center conductor wire and the ending ¼" of the twisted strand.

Lay the two 17-5/8" elements, back-side up, on three sheets of paper towels, with the tinned ends facing each other. Lay the hairpin match across the two tinned ends of the 17-5/8" elements, then the tinned center conductor of the coax next to one of them. In my case, I used the crimpers and the wire cutters to hold these three in place before I started soldering. Solder the three together. After about thirty seconds of cooling, repeat for the twisted strand of the coax. Zip-tie the coax—hairpin—element assembly to one of the slip crosses.

Fold the 35-1/8" element in a rounded half, mark the middle point on the back-side, and zip-tie it to the PVC slip T, the numerals on the tape measure elements facing the PVC slip T. Repeat this with the 41-3/8" element, but on the remaining PVC slip cross.



DIY, continued

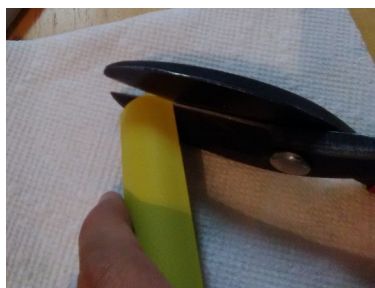
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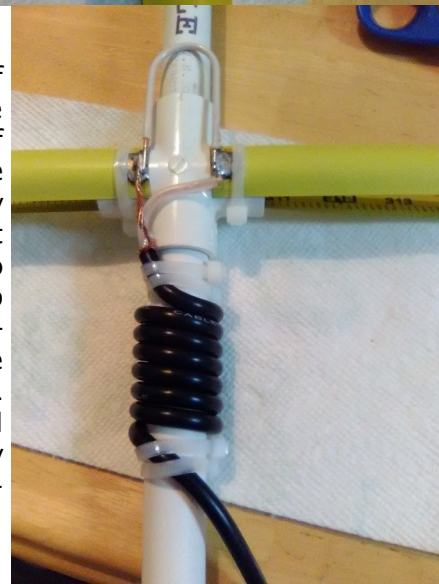
Cut the $\frac{1}{2}$ " PVC tube into three lengths, 5", 7", and 11- $\frac{1}{2}$ ". Insert one end of the 7" PVC tube firmly into the coax end of the PVC slip cross holding the 17- $\frac{5}{8}$ " elements. Line up the coax jacket edge with the PVC slip cross edge, and zip-tie the coax to the 7" PVC tube twice. As tightly as you can (you shouldn't be able to see any gaps between the coax windings), wind the coax around the 7" PVC tube seven times (direction doesn't matter), then zip-tie the end twice again. This is your coax **balun**, which acts as an *RF choke* and helps center the antenna pattern.



Insert one end of the 11- $\frac{1}{2}$ " PVC tube into the middle hole of the PVC slip T, and the other end into the hairpin end of the PVC slip cross holding the 17- $\frac{5}{8}$ " elements. Slip one end of the PVC slip cross holding the 41- $\frac{3}{8}$ " element onto the empty end of the 7" PVC tube. Insert one end of the 5" PVC tube into the other end of the PVC slip cross holding the 41- $\frac{3}{8}$ " element, then slip the cap on the other end of the 5" PVC tube. Finally, snip the corners off all six elements, to minimize injury

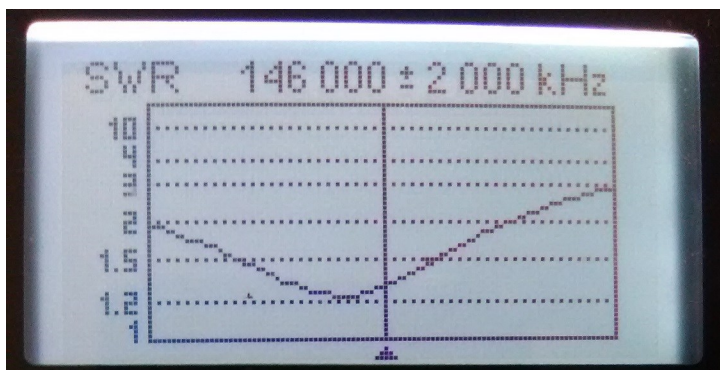


from the sharp element ends. You can alternatively use electrical tape to do the same.



Test time

Your 2-meter tape measure Yagi is now ready to measure. Once I connected mine to my analyzer, I set it for 2 meters, and I like the result. It's not perfect, by any means, but definitely workable by a handheld transceiver. [Online documentation](#) shows this antenna's gain to be around 7.3 dBd, but I believe that figure is the result of a simulation (by [YagiCAD](#)), not actual measurement. Still, it does seem to have a lot more than unity gain when I took it for a spin out in the country in southern Utah.



Because this is a Yagi antenna, it's directional, so we're going to need to test its *directivity* as well. One way to do that is by contacting a friend on simplex, then asking for signal reports as you swing your antenna towards your friend, and away. I believe you'll be pleased by what you'll hear.

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